

Claims

1. Device (1) for the detection of at least one ligand (2) contained in a sample that is to be analyzed, with an optical waveguide (4), on the surface of which at least one receptor (5) is directly or indirectly immobilized which, when it comes into contact with the ligand (2), forms a specific bond with the ligand (2), with at least one optical source of radiation (8) for injecting excitation radiation (9) into the waveguide (4), the radiation being used for exciting the emission of luminescence radiation (10) as a function of the bonding of the ligand (2) to the receptor (5), and with a semiconductor chip (3) that has at least one radiation receiver (12) on a semiconductor substrate to detect the luminescence radiation (10), **characterized by the fact** that the waveguide (4) is monolithically integrated with the semiconductor substrate or is located on the semiconductor (3).
2. Device (1) as recited in Claim 1, characterized by the fact that the waveguide (4) extends to over the at least one radiation receiver (12) and that the at least one receptor (5) is located on the surfaces of the waveguide (4) preferably directly opposite the radiation receiver (12).
3. Device (1) as recited in Claims 1 or 2, characterized by the fact that the waveguide layer is directly adjacent to the semiconductor chip (3), that the topography of the semiconductor chip (3) in the area of the semiconductor chip adjacent to the waveguide (4) is realized so the boundary surface (14) opposite the at least one receptor (5) between the semiconductor chip (3) and the waveguide (4) runs between two planes (14a, 14b) that are oriented parallel to the plane of extension of the semiconductor chip (3), whereby the distance (x) between said two planes is less than the wavelength of the excitation radiation (9), in particular less than one-half, preferably one-fourth and optionally one-eighth of the wavelength of the excitation radiation (9).
4. Device (1) as recited in one of the Claims 1 to 3, characterized by the fact that the semiconductor chip (3), laterally next to the waveguide (4), has structures (13) for an electronic circuit.

5. Device (1) as recited in one of the Claims 1 to 4, characterized by the fact that between the semiconductor chip (3) and the waveguide (4) there is an intermediate layer (15), the optical index of refraction of which is less than that of the waveguide (4), that the intermediate layer (15) has the negative shape of the semiconductor chip (3), to which it is directly adjacent on the semiconductor chip (3), and that the front side of the intermediate layer (15) that faces away from the semiconductor chip (3) and is directly adjacent to the waveguide (4) is essentially plane.
6. Device (1) as recited in one of the Claims 1 to 5, characterized by the fact that the intermediate layer is realized in the form of an adhesive coating, preferably in the form of a polymer coating.
7. Device (1) as recited in one of the Claims 1 to 6, characterized by the fact that the waveguide (4) is connected with the semiconductor chip (3) by means of at least one bonding point.
8. Device (1) as recited in one of the Claims 1 to 7, characterized by the fact that the waveguide (4) is realized in the form of a thin-film layer that preferably consists of a transparent polymer material, in particular polystyrene.
9. Device (1) as recited in one of the Claims 1 to 8, characterized by the fact that the waveguide (4) is formed by a metal oxide layer, in particular a silicon dioxide layer or a tantalum pentoxide layer.
10. Device (1) as recited in one of the Claims 1 to 9, characterized by the fact that the optical radiation source (8) is realized in the form of a semiconductor radiation source and is integrated into the semiconductor chip (3).
11. Device (1) as recited in one of the Claims 1 to 10, characterized by the fact that for the injection of the excitation radiation (9) into the waveguide (4), an optical injection system (11) is provided in the emission area of the optical radiation source (8), which system is preferably realized in one piece with the waveguide (4) and in particular has at least one prism, an optical lattice and/or a deflecting mirror.

12. Device (1) as recited in one of the Claims 1 to 11, characterized by the fact that a plurality of radiation receivers (12) are integrated into the semiconductor substrate, preferably in the form of rows or a matrix, that in the detection range of each of the individual radiation receivers (12) there is at least one detection field that has at least one receptor (5).
13. Device (1) as recited in one of the Claims 1 to 12, characterized by the fact that the detection fields are at some distance from one another and are positioned relative to the radiation receivers (12) so that the individual radiation receivers (12) receive essentially no luminescence radiation from a detection field of another radiation receiver (2).
14. Device (1) as recited in one of the Claims 1 to 13, characterized by the fact that the at least one receptor (5) is located in the interior cavity (17) of a flow-through measurement chamber that has at least one inlet opening (19) and one outlet opening (19), and that the semiconductor chip (3) preferably forms a wall area of the flow-through measurement chamber.
15. Device (1) as recited in one of the Claims 1 to 14, characterized by the fact that to control the temperature of the flow-through measurement chamber a heating and/or cooling device is provided, which preferably has a Peltier element.
16. Device (1) as recited in one of the Claims 1 to 15, characterized by the fact that in the flow-through measurement chamber there is at least one reagent and/or reaction partner for the detection of the bonding of the at least one ligand (2) to the at least one receptor (5).